

WHAT IS CLAIMED:

sub A1 1. A method for selectively removing at least one coating from the surface of a substrate, comprising the step of contacting the coating with an aqueous composition which comprises an acid having the formula H_xAF_6 , or precursors to said acid, wherein A is selected from the group consisting of Si, Ge, Ti, Zr, Al, and Ga; and x is 1-6.

2. The method of claim 1, wherein x is 1-3.

3. The method of claim 1, wherein the acid is present at a level in the range of about 0.05 M to about 5 M.

4. The method of claim 3, wherein the acid is present at a level in the range of about 0.2 M to about 3.5 M.

5. The method of claim 1, wherein the precursor is a salt of the acid.

6. The method of claim 1, wherein the aqueous composition comprises the compound H_2SiF_6 or H_2ZrF_6 .

7. The method of claim 6, wherein the H_2SiF_6 compound is formed in situ within the aqueous composition, by the dissociation of a corresponding salt of the compound; or by the reaction of a silicon-containing compound with a fluorine-containing compound.

8. The method of claim 7, wherein the silicon-containing compound is SiO_2 , and the fluorine-containing compound is HF.

9. The method of claim 1, wherein the aqueous composition further comprises at least one additional acid or precursor thereof.

10. The method of claim 9, wherein the additional acid has a pH of less than about 7 in pure water.

11. The method of claim 10, wherein the additional acid has a pH of less than about 3.5 in pure water.

12. The method of claim 9, wherein the additional acid is a mineral acid.

13. The method of claim 9, wherein the additional acid is selected from the group consisting of phosphoric acid, nitric acid, sulfuric acid, hydrochloric acid, hydrofluoric acid, hydrobromic acid, hydroiodic acid, acetic acid, perchloric acid, phosphorous acid, phosphinic acid, alkyl sulfonic acids, and mixtures of any of the foregoing.

14. The method of claim 9, wherein the additional acid is present in the composition at a level in the range of about 0.1 M to about 20 M.

15. The method of claim 14, wherein the additional acid is phosphoric acid.

16. The method of claim 15, wherein the phosphoric acid is present at a level in the range of about 0.5 M to about 5 M.

17. The method of claim 1, wherein the substrate is immersed in a bath of the aqueous composition.

18. The method of claim 17, wherein the bath is maintained at a temperature in the range of about room temperature to about 100°C, while the substrate is immersed therein.

19. The method of claim 18, wherein the temperature is in the range of about 45°C to about 90°C.

20. The method of claim 18, wherein the immersion time is in the range of about 10 minutes to about 72 hours.

21. The method of claim 20, wherein the immersion time is in the range of about 60 minutes to about 20 hours.

22. The method of claim 17, wherein the bath further comprises at least one additive selected from the group consisting of inhibitors, dispersants, surfactants, chelating agents, wetting agents, deflocculants, stabilizers, anti-settling agents, and anti-foam agents.

23. The method of claim 1, wherein the coating being removed from the substrate comprises at least one diffusion coating or overlay coating.

sub A2 24. The method of claim 23, wherein the diffusion coating comprises an aluminide material.

sub B7 25. The method of claim 24, wherein the aluminide material is selected from the group consisting of aluminide, noble metal-aluminide, nickel-aluminide, noble metal-nickel-aluminide, and mixtures thereof.

sub A3 26. The method of claim 23, wherein the overlay coating comprises MCrAl(X), where M is an element selected from the group consisting of Ni, Co, Fe, and combinations thereof, and X is an element selected from the group consisting of Y, Ta, Si, Hf, Ti, Zr, B, C, and combinations thereof.

sub B7 27. The method of claim 1, wherein the substrate is selected from the group consisting of a metallic material and a polymeric material which is substantially resistant to strong acids.

15 28. The method of claim 27, wherein the polymeric material is selected from the group consisting of polyolefins, polytetrafluoroethylenes, epoxy resins, polystyrenes, polyphenylene ethers; mixtures comprising one of the foregoing; and copolymers comprising one of the foregoing.

20 29. The method of claim 27, wherein the metallic material comprises at least one element selected from the group consisting of iron, cobalt, nickel, aluminum, chromium, titanium, and mixtures which include any of the foregoing.

30. The method of claim 29, wherein the metallic material comprises a superalloy.

25 31. The method of claim 30, wherein the superalloy is nickel-based or cobalt-based.

32. The method of claim 30, wherein the superalloy is a component of a turbine engine.

33. The method of claim 32, wherein the component comprises an airfoil.

sub A9 > 34. A method for selectively removing at least one coating material from the surface of a metallic substrate, comprising the step of contacting the coating with an aqueous composition which comprises an acid having the formula H_xAF_6 , or precursors to said acid, wherein A is selected from the group consisting of Si, Ti, and Zr; and x is 1-3.

sub B7 35. The method of claim 34, wherein the acid is present at a level in the range of about 0.05 M to about 5 M.

10 36. The method of claim 34, wherein the aqueous composition further comprises at least one additional acid or precursor thereof, selected from the group consisting of phosphoric acid, nitric acid, sulfuric acid, hydrochloric acid, hydrofluoric acid, and mixtures thereof.

15 37. The method of claim 36, wherein the additional acid is present in the composition at a level in the range of about 0.1 M to about 20 M.

sub A5 > 38. The method of claim 34, wherein the coating is selected from the group consisting of aluminides or MCrAlY materials, wherein M is an element selected from the group consisting of Ni, Co, Fe, and combinations thereof.

sub B7 39. The method of claim 34, wherein the coating material comprises an MCrAlY layer which is diffusion-aluminided.

40. The method of claim 34, wherein the metallic substrate comprises a nickel-base or cobalt-base superalloy.

41. The method of claim 40, wherein the metallic substrate is a turbine engine airfoil.

25 42. An aqueous composition for selectively removing a coating from the surface of a substrate, comprising an acid having the formula H_xAF_6 , or precursors to said acid, wherein A is selected from the group consisting of Si, Ge, Ti, Zr, Al, and Ga; and x is 1-6,

said acid being present in the composition at a level in the range of about 0.05 M to about 5 M.

43. The composition of claim 42, further including at least one additional acid or precursor thereof.

5 44. The composition of claim 43, wherein the additional acid has a pH of less than about 7 in pure water.

45. The composition of claim 44, wherein the additional acid has a pH of less than about 3.5 in pure water.

10 46. The composition of claim 43, wherein the additional acid is a mineral acid.

15 47. The composition of claim 43, wherein the additional acid is selected from the group consisting of phosphoric acid, nitric acid, sulfuric acid, hydrochloric acid, hydrofluoric acid, hydrobromic acid, hydriodic acid, acetic acid, perchloric acid, phosphorous acid, phosphinic acid, alkyl sulfonic acids, and mixtures of any of the foregoing.

48. The composition of claim 43, wherein the additional acid is present in the composition at a level in the range of about 0.1 M to about 20 M.